

CLAIMS

What I claim is:

1. A device for detecting airborne conductive or dielectric particles, comprising:
 - a resonant cavity having a high E field sensing region;
 - means for feeding power to the cavity;
 - means for directing an airborne particle through the high E field sensing region of the cavity; and
 - sensing means coupled to the cavity for sensing the drop in E field level caused by the particle and outputting a signal representative thereof.
2. The device according to claim 1, wherein said output signal is proportional to the volume concentration of said airborne conductive particles.
3. The device according to claim 1, further comprising means for measuring the volume concentration of conductive particles comprising:
 - means for measuring the air volume flow rate through the high E field sensing region of the cavity; and
 - means for counting the number of signals outputted by the sensing means per unit time.
4. The device according to claim 1, further comprising means for measuring the mass flow rate of airborne conductive particles comprising:
 - means for drawing said airborne conductive particles through said resonant region;

5 means for measuring the volume of air flowing through the high E field sensing
6 region of the cavity per unit time; and

7 means for measuring the average height of the signals outputted by the sensing
8 means per unit time.

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1 5. The device according to claim 4, further comprising means for displaying the
2 count of signal outputted by said sensing means.

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1 6. The device according to claim 1 further comprising means for displaying a
2 histogram of the effective conductivity of airborne conductive particles comprising:
3 means for measuring the height of each signal outputted by the sensing means per
4 unit time;

5 means for counting the number of signals of a given height outputted by the
6 sensing means per unit time;

7 a memory storage register having an address number proportional to signal
8 height;

9 means for storing the count in the memory storage register at the respective
10 address number; and

11 means for displaying the count from each address number of the memory storage
12 register as a function of address number.

1 7. The device according to claim 1, wherein said means for directing an airborne
2 particle has an input and includes a vacuum source and wherein said device further
3 comprises:

4 a conduit for receiving said airborne particles being detected, said conduit being
5 dimensioned so as to direct the flow of the received particles into at least two paths with
6 the first path having a concentrated amount of received particles and being in fluid
7 communication with said input of means for directing an airborne particle, and with the
8 second path carrying the remainder of received particles and being in fluid
9 communication with said vacuum source.

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1 8. The device according to claim 7, wherein said conduit is dimensioned so that said
2 first path is along the centrifugal direction of the airborne particles being received by said
3 conduit.

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1 9. The device according to claim 7, wherein said airborne particles have a desired
2 size capable of being detected and wherein said conduit comprises:

3 a nozzle having an input for receiving said airborne particles and providing an
4 output, said nozzle being dimensioned to provide at least first and second streamlines
5 with the first streamline defining a path line for the trajectory of airborne particles having
6 a size smaller than the size of airborne particles desired to be detected, and with the
7 second streamline defining a path for the trajectory of airborne particles having a size
8 equal to or greater than the size of airborne particles desired to be detected; and

first, second and third probe tubes each located at said output of said nozzle, said first probe tube being arranged to receive the airborne particles associated with said first streamline, said second probe tube being arranged to receive the airborne particles associated with said second streamline and said third probe tube being arranged to receive the airborne particles that are not associated with either of said first or second streamlines, said first and third probe tubes both being in fluid communication with said vacuum source and said second probe tube being in fluid communication with said input of said means for directing an airborne particle.

10. An arrangement for detecting the x, y, and z components of airborne conductive particles, comprising:

first, and second waveguides each having a cavity with a high E field sensing region and a third cavity with a high E field sensing region, said three E field sensing regions being orthogonally arranged relative to each other so that x, y, and z sensing fields are provided;

means for feeding power to said three cavities;

means for directing an airborne particle through the high E field sensing region of the cavity of the x sensing field; and

sensing means coupled to each of the three cavities for sensing the drop in E field level caused by the particle and outputting a signal representative thereof.

11. An arrangement for detecting the x, y, and z components airborne conductive particles, comprising:

3 a resonant cavity with an input port and an opening near said input port and
4 having a high E field sensing region;
5 means for feeding power to the cavity;
6 means for directing an airborne particle into said input port of the resonant cavity
7 and through the high E field sensing region of the cavity; and
8 sensing means coupled to the cavity for sensing the drop in E field level caused
9 by the particle and outputting a signal representative thereof.

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1 12. A device for detecting airborne conductive or dielectric particles, comprising:
2 a resonant cavity having dimension wherein its height is greater than its width and
3 having a high E field sensing region;
4 means for feeding power to the cavity;
5 means for directing an airborne through the high E field sensing region of the
6 cavity; and
7 sensing means coupled to the cavity for sensing the drop in E field level caused
8 by the particle and outputting a signal representative thereof.

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1 13. The device according to claim 12, wherein said cavity has a resonant frequency
2 and wherein said means for feeding power supplies an excitation frequency slightly
3 higher than said resonant frequency.

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1 14. A method for detecting airborne conductive or dielectric particles, comprising the
2 steps of:

providing a resonant cavity having a high E field sensing region;
feeding power to the cavity;
directing an airborne particle through the high E field sensing region of the cavity;
and
providing sensing means coupled to the cavity for sensing the drop in E field level
caused by the particle and for outputting a signal representative thereof.

15. The method according to claim 14, wherein said cavity has a resonant frequency and wherein said feeding power supplies an excitation frequency slightly higher than said resonant frequency.

16. The method according to claim 14, wherein said output signal is proportional to the volume concentration of said airborne conductive particles.

17. The method according to claim 14, further comprising providing means for measuring the volume concentration of conductive particles comprising:

providing means for measuring the air volume flow rate through the high E field sensing region of the cavity; and

providing means for counting the number of signals outputted by the sensing means per unit time.

18. The method according to claim 14, further comprising providing means for measuring the mass flow rate of airborne conductive particles comprising:

3 drawing said airborne conductive particles through said resonant region;
4 measuring the volume of air flowing through the high E field sensing region of
5 the cavity per unit time;

6 measuring the average height of the signals outputted by the sensing means per
7 unit time.

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1 19. The method according to claim 17, further comprising providing means for
2 displaying the count of signal outputted by said sensing means.

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1 20. The method according to claim 14, further comprising displaying a histogram of
2 the effective conductivity of airborne conductive particles comprising:

3 measuring the height of each signal outputted by the sensing means per unit time;
4 counting the number of signals of a given height outputted by the sensing means
5 per unit time;

6 providing a memory storage register having an address number proportional to
7 signal height;

8 storing the count in the memory storage register at the respective address number;
9 and

10 displaying the count from each address number of the memory storage register as
11 a function of address number.

12 21. A method for detecting airborne conductive particles, comprising the steps of:

2 providing a resonant cavity having dimension wherein its height is greater than its
3 width and having a high E field sensing region;

4 feeding power to the cavity;

5 directing an airborne particle through the high E field sensing region of the cavity;
6 and

7 providing sensing means coupled to the cavity for sensing the drop in E field level
8 caused by the particle and for outputting a signal representative thereof.

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1 22. The method according to claim 21, wherein said cavity has a resonant frequency
2 and wherein said power supplied to said cavity is at an excitation frequency slightly
3 higher than said resonant frequency.

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1 23. The method according to claim 21, wherein said means for directing an airborne
2 particle is directed by a device having an input and includes a vacuum source and
3 wherein said method further comprising the step of:

4 providing a conduit for receiving said airborne particles being detected and
5 dimensioned so as to direct the flow of the received particles into at least two paths with
6 the first path having a concentrated amount of received particles and being in fluid
7 communication with said input of device for directing an airborne particle, and with the
8 second path carrying the remainder of received particles and being in fluid
9 communication with said vacuum source.

1 24. The method according to claim 23, wherein said conduit is dimensioned so that
2 said first path is along the centrifugal direction of the airborne particles received by said
3 conduit.

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1 25. The method according to claim 23, wherein said airborne particles have a desired
2 size capable of being detected and wherein said conduit comprises:

3 a nozzle having an input for receiving said airborne particles and providing an
4 output, said nozzle being dimensioned to provide at least first and second streamlines
5 with the first streamline defining a path line for the trajectory of airborne particles having
6 a size smaller than the size of airborne particles desired to be detected, and with the
7 second streamline defining a path for the trajectory of airborne particles having a size
8 equal to or greater than the size of airborne particles desired to be detected; and

9 first, second and third probe tubes each located at said output of said nozzle, said
10 first probe tube being arranged to receive the airborne particles associated with said first
11 streamline, said second probe tube being arranged to receive the airborne particles
12 associated with said second streamline and said third probe tube being arranged to
13 receive the airborne particles that are not associated with either of said first or second
14 streamlines, said first and third probe tubes both being in fluid communication with said
15 vacuum source and said second probe tube being in fluid communication with said input
16 of said device for directing an airborne particle.